DOE-ID ARCHITECTURAL ENGINEERING STANDARDS	TITLE:	PIPING GENERAL REQUIRMENTS		
	DATE:	November 2001	SECTION:	1540

1540-1. CODES AND STANDARDS

1.1 Applicable Codes and Standards

- AES 0100-1, Codes and Standards
- ASME/ANSI B31.1, Power Piping.
- ASME/ANSI B31.3, Chemical Plant and Petroleum Refinery Piping.
- ASME/ANSI B31.9, Building Service Piping.
- IAPMO, International Plumbing Code
- NFPA 54/ANSI A223.1, National Fuel Gas Code.
- NFPA 58, Standard for the Storage and Handling of Liquefied Petroleum Gases.

1.2 Piping Codes for Specific Facilities

- FAST Facility at INTEC – The FAST facility was built using ANSI B31.1 as the code of record for process piping systems. Modifications to existing process piping systems within FAST should use ANSI B31.1 unless otherwise stated in approved design criteria.
- See Appendix M of these standards for piping material requirements. The standard materials are required for new work at INTEC and recommended at other INEEL facilities.

1540-2. GENERAL

The following requirements apply to all the piping sections in this division.

2.1 For welding of pressure piping see Section 0532.

2.2 For requirements for underground piping see Section 0260.

2.3 Pipe insulation and other similar materials containing asbestos shall not be used. Pipe insulation shall be compatible with the piping material.

2.4 The designer should coordinate piping locations with the electrical designer when using common spaces for piping runs. See the NEC 310-10 and 384-2 for specific requirements. Hot pipes whose temperatures at the exterior surfaces will normally exceed 86°F (30°C) shall not be routed closer than 6 in. to an electrical raceway.

2.5 The location of potential leak points such as valves should be established to minimize economic losses if a leak should occur. This is particularly important in piping systems containing acids or other hazardous fluids. If this is not possible, the use of welded fittings and sealed bellows-type valves is required in these areas.

2.6 Swagelok^{R} (Crawford) compression fittings shall be used where tubing is permitted.

2.7 Maintenance shall be a primary consideration in the design of piping systems. Prevention of plugging and clearing of plugs when they occur shall be considered in the design. Systems should be designed so that pockets or traps

are eliminated and piping can be flushed and drained, except where loop seals are included in the design. Connections suitable for remote handling shall be used when required by the project design criteria.

2.8 Teflon^{R} shall not be used for gasket material or as a component part of any valve or other piece of equipment subject to ionizing radiation where life cycle exposure exceeds 100R.

1540-3. COLOR CODING AND IDENTIFICATION OF PIPING

3.1 In general, all exposed piping shall be color coded and identified in accordance with ANSI A-13-1. It is the intent of this standard that the identification method of above ground piping is by English text that allows the contents to be readily identified. Arrows should also show flow direction. For in-cell piping, see 3.3 below.

3.2 All piping and equipment shall be identified and numbered on design drawings in accordance with established site standards, which will be provided by the OC. Piping identification legends and symbols for ICPP shall conform to the appropriate ICPP drawing listed in Appendix D.

3.3 In locations such as hot process cells, remote handling cells, etc., where identification by stencil or paint may not be feasible because of periodic cleaning with highly corrosive cleaning solutions, the piping shall be identified with beaded chain or cable stainless steel tags containing the line or equipment designation.

3.4 In addition to the requirements specified herein, all pipelines and equipment at ICPP shall be color coded and identified according to Appendix M of this standard and shall be tagged with beaded chain or steel cable stainless steel tags displaying the pipe or equipment number as shown on the drawings. The tags shall be fabricated from 300 series austenitic stainless steel metal strips 3/4-in. wide, 24 gauge minimum thickness, with 3/16 in. high letters stamped on the metal surface. Tagging for pipe shall be done at approximately 20-ft intervals with at least one tag in each room. Any pipes entering or leaving a room shall be tagged on each side of the wall. The tags shall be attached to the pipe or austenitic equipment with austenitic stainless steel bead chain or austenitic stainless steel cable. When tagging valves, the bead chain shall be attached to the valve stem or yoke. Remotely replaceable equipment, such as valve jumpers, instrument jumpers, etc., shall also be identified and tagged.

1540-4. CATHODIC PROTECTION OF BURIED PIPE

Cathodic protection requirements shall be provided by the project design criteria. See AES-1660-4 for design requirements.

1540-5. SPECIAL CONSIDERATIONS FOR HAZARDOUS AND CORROSIVE

MATERIAL PIPING

5.1 Piping systems containing radioactive fluids shall meet any additional requirements specified in the project design criteria.

5.2 All flanges and valve stems in hazardous/corrosive chemical service shall be equipped with protective shields.

5.3 Loop seals shall not be used to prevent backflow of contaminated gases unless no other practical means are available. Systems shall be designed to minimize exposure of maintenance personnel to radiation or hazardous materials.

5.4 Full-penetration butt welds, when feasible, are the preferred joints for pipelines where corrosion or contamination is a concern. When modifying existing pipelines in contaminated and radiation areas where butt-welding is not practical due to ALARA considerations, purging difficulties, or access constraints, then socket welds are recommended as the best second choice if the corrosion service allows it. Consult the requirements on welded joints in metallic piping in ASME/ANSI B31.3.

5.5 NPT fittings are not allowed in corrosion services and radioactively contaminated services except for instruments and equipment where welded ends are not available (such as pressure gages, pumps, etc.). Butt-weld or socket-weld joints are preferred in all other cases. Consideration should be given to boring out these NPT fittings for equipment described above for socket welding where practical (such as for pumps). Backwelding of NPT fittings does not substantially mitigate the poor corrosion performance of a threaded connection and shall only be allowed with prior written approval of the OC's AE.

5.6 Where tubing and fittings are used in applications having direct or indirect contact with either radioactive contamination or corrosive chemicals, they shall be fabricated of an austenitic stainless steel as a minimum or a suitable corrosion resistant material.

5.7 Consideration shall be given to installing valves and equipment with "Grayloc" type single bolt swingout type fittings whenever practical to allow removal or maintenance without dismantling the associated piping.

5.8 Radioactive and hazardous material transfer lines shall be routed inside buildings or enclosures where possible to minimize length of buried pipelines. The design shall consider the need for protection of the primary line from external corrosion. Cathodic protection or separation of the primary line from the soil may be necessary.

5.9 Buried pipelines for transporting hazardous materials shall receive particular design attention with regard to corrosion or possible mechanical damage from expansion forces, future excavation, earth settlement, vibration, seismic loads, surcharge, other live loads and dead loads. Piping requirements located in

40-CFR 280, Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks shall be followed where applicable. Where specified in the design criteria, buried pipelines carrying highly radioactive and other hazardous liquids or solids shall be doubly contained, i.e., the primary pipeline containing the contaminant shall be fully encased and supported inside a corrosion-resistant, leak-tight pipe duct. The outer or casing line shall be so designed as to permit detection of any leakage from the primary line (sampling sumps, radiation detectors, etc.) and shall permit periodic leak testing of the casing line. Design shall include the following considerations:

(a) Encasement of pipeways is required for protection of pipelines that carry highly radioactive wastes. Drains from a series of encasements should culminate at a single sample point. Automated routine monitoring, using a sampling system and radiation detectors, shall be considered. Individual sump radioactive detectors shall be considered. Individual sumps and risers must provide for manual sampling to determine which encasement contains leaking pipe and which primary pipe is leaking.

(b) Appropriate spacers shall separate the primary line and the encasement pipe. The encasement pipe shall slope to a collection point to provide drainage for leaks from the primary line.

(c) Connections to existing underground lines carrying radioactive materials shall be made in encasements, pipe tunnels, or manifold vaults to prevent potential leakage into the soil. Consideration shall be given to construction of a manifold vault adjacent to any multi-source tank vault to permit addition or removal of lines draining to the tank.

(d) Unmonitored vents and vent drain lines shall not be connected to underground solution transfer lines carrying radioactive materials.

5.10 Unless no other practical means are available, drain lines for radioactively contaminated waste shall not use liquid seal traps (loop seals) for preventing backflow of gases. Provision shall be made to prevent the backflow of contaminated gas by other means, such as maintaining a negative pressure on the drain system, use of self-closing check valves, etc. In addition, all drain fixtures for radioactive drain lines shall be provided with caps or plugs to block off the fixture when not in use. The drain system must be a separate system, i.e., no permanent connections to any other system.

5.11 Notches, cracks, crevices, or rough surfaces that might retain radioactive materials or contribute to corrosion shall be avoided in the design of process piping.

5.12 Every pipe entering a process cell shall be equipped with a suitable block valve. Piping contacted by process solutions shall be equipped with a packless block valve immediately outside the cell wall. Piping contacted by process solutions

in a normally pressurized system may require a check valve in addition to the packless block valve. Piping that is not contacted by process solutions in normal operation may be equipped with a block valve. Piping that is not contacted by process solutions except by failure of a pressure boundary component may be equipped with a gate valve. In every case, the primary block valve and/or check valve shall be of equivalent corrosion resistant material to the associated in-cell piping.

5.13 Off-gas systems must be properly engineered for the risk involved, i.e., sufficient capacity, properly scrubbed, filtered, and discharged to the outside.

5.14 Acid or caustic materials handling equipment, i.e., piping systems, tanks, pumps, structural supports to such equipment, etc. must be compatible with the material they will be handling. This compatibility requirement extends to external fasteners that are normally not in contact with acid solutions (wetted) but may be exposed during a spill. Corrosion-resistant materials for each individual application shall be used and corrosion allowances shall be evaluated and used for each application.

5.15 Acid systems must be totally bermed. If tanks, pipes, and pumps are located in a chemical handling room, then that room should be considered a total acid handling area, properly bermed, appropriately drained, correctly posted as to hazard(s), and the berm provided with a stainless steel liner or approved protective paint.

5.16 There should be no penetrations in the floor of the bermed area or in the berm itself, except for a floor drain to an approved holding tank.

5.17 The acid handling area must be isolated physically, including the heating and ventilation equipment, from other areas within the facility.

5.18 Spill control equipment should be located away from the projected spill area to assure access; and consideration should also be given to locating staging areas in response to such projected spills.